

Doridacean Nudibranchs from Sri Lanka, with Descriptions of Four New Species

by

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Abstract. Eight doridacean nudibranchs from northeastern Sri Lanka are described and illustrated. Of these, two chromodorids, *Chromodoris conchylata* and *C. adeima*, are new species. Two of the three phyllidiids found also are new to science, *Phyllidia empelia* and *P. alia*. The third, *P. varicosa*, as well as *Gymnodoris citrina* are new records for Sri Lanka.

INTRODUCTION

THE MAJORITY OF observations on the opisthobranch mollusks of the Indian Ocean have been concentrated along the east coast of Africa: EDMUNDS (1971) described the Doridacea from Tanzania and sixteen opisthobranch mollusks from the Seychelles, Tanzania, and the Congo (EDMUNDS, 1972). Rudman worked from eastern Africa across to the tropical West Pacific (RUDMAN, 1977), as well as in the Indo-West Pacific (RUDMAN, 1973, 1982). The Red Sea has furnished a number of scientific collections: one of the first was ELIOT's (1908) collection near Sudan. MARCUS & MARCUS (1959) reported on the Red Sea and the Maldives. GOHAR & ABUL-ELA (1959) studied the development of three Red Sea nudibranchs, and more recently SOLIMAN (1978, 1980) has been working on the biology of Red Sea dorids.

The first records of opisthobranch mollusks from Sri Lanka were published by KELAART (1858, 1859) and were based on collections made in the vicinity of Trincomalee. Walter Elliot collected along the northwestern coast of India during the period 1853-54, accompanying his collection of 41 species with accurate drawings. He sent his drawings and preserved specimens to ALDER & HANCOCK in England, who published their studies in 1864. C. N. E. ELIOT (1906) reviewed these early finds, in addition to FARRAN's (1905) work and BERGH's (1905) extensive collections. Work on Indian and Ceylonese opisthobranchs was thereafter sporadic: ELIOT (1909) added further details of fresh specimens to his previous work on Kelaart's animals; O'DONOGHUE (1932) made notes on 18 species of nudibranchs and ascoglossans from the Gulf of Ma-

naar; WINCKWORTH (1946) wrote on five species of chromodorids he found in Bombay. More recently, BURN (1970) has drawn attention to the Phyllidiidae in redescriving the rare *Phyllidia zeylanica*, rediscovered after almost 100 years in the Gulf of Kutch, western India.

The opportunity arose while visiting Sri Lanka during the summer of 1981 to initiate a new investigation into the opisthobranch Mollusca and their habitats in the region of Trincomalee, the site of Kelaart's first collection of opisthobranchs in Ceylon.

Sri Lanka is a large island, approximately 65,600 km² in area, situated in the Indian Ocean southeast of Cape Cormorin in India. The city of Trincomalee is located on the northeastern coast, which is characterized by sandy bays enclosed within rocky outcrops, with some well-developed lagoon areas and a few coral islands and bays. This coast is exposed to strong winds during four months of the year, with maxima in January (U.S. NAVY, 1957).

In this investigation, 14 species of opisthobranchs were found, 8 of which belong to the suborder Doridacea. Four are described as new species, two Chromodorididae and two Phyllidiidae. Of the remaining four, two are new records for Sri Lanka, *Gymnodoris citrina* and *Phyllidia varicosa*. *Gymnodoris citrina* is redescrived and the problem of discriminating between *G. bicolor* and *G. citrina* is discussed. New observations are presented on the anatomy and histology of several species.

COLLECTION AND METHODS

All the specimens were collected from three localities north of Trincomalee in relatively shallow water (1-4.5 m): none of the reefs is exposed at low tide. Descriptions, drawings, and color photographs of external features were made from life. Anatomical investigations were made using specimens relaxed in 7% magnesium chloride, pre-

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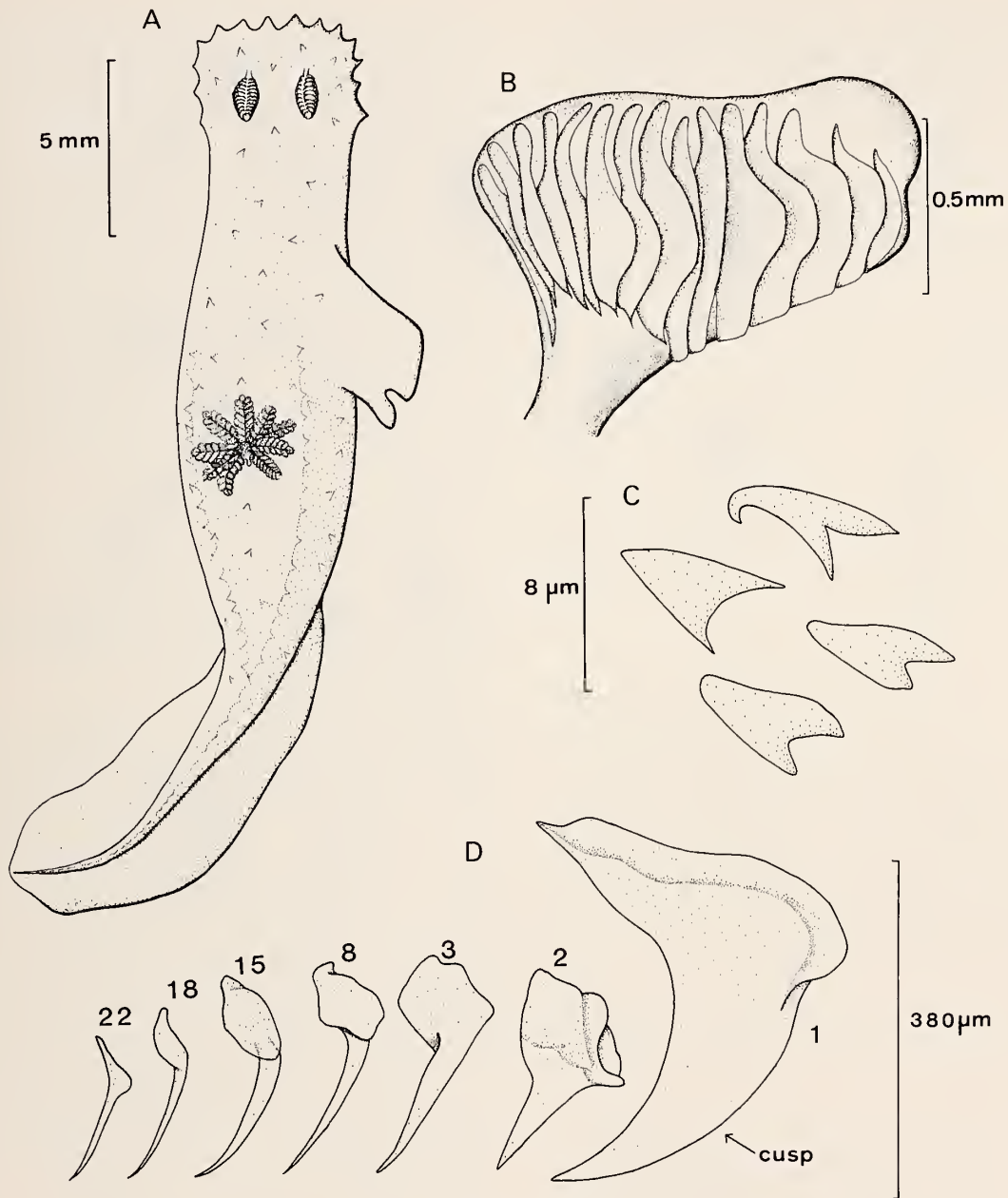


Figure 1

Gymnodoris citrina A. dorsal aspect; B. side view of the rhinophore; C. penial spines (with aid of camera lucida); D. radular teeth (with aid of camera lucida).

served in 4% formalin, and later transferred into 70% alcohol. Jaw and radula preparations were made by removing the buccal mass, dispersing the flesh in warm caustic soda (NaOH), and mounting in polyvinyl lactophenol with lignin pink. The reproductive organs of the single specimens were not dissected in order to preserve the type specimens as completely as possible after removing the radula.

Holotypes and paratypes of the new species have been lodged in the British Museum (Natural History).

Gymnodoris citrina (Bergh, 1877)

(Figure 1)

Trevelyana citrina BERGH, 1877
Gymnodoris citrina: YOUNG, 1967

Material and locality: One specimen, collected under a rock at a depth of 2 m off Pigeon Island (northeast of Trincomalee), on 26 August 1981.

Description: The specimen was 28 mm long and approximately 5 mm wide. It is milky white with small, orange-yellow, low-pointed papillae scattered over the dorsal surface. It is not bilaterally symmetrical; the enlarged genital papilla (now a tube in the preserved specimen) is located to the right of the midline, anterior to the gills, and the branchiae are to the left of the median. Two rows of orange-yellow pointed papillae form a slightly asymmetrical V-shaped pattern on either side of the branchiae. The dorsal surface of the tail and the genital papilla are free of papillae. The front of the mantle is broadly rounded and bears 14 pointed orange-yellow projections (Figure 1A).

The bulbous rhinophores are darker than the pallial tubercles and distinctive in shape. They each have a thin stalk, 15 vertical lamellae, and a swollen club at the distal end (Figure 1B). The branchiae are 9 in number, set in a crescent shape anterior to the small anal papilla. In life, the gills were translucent white, and retracted after much stimulation.

The radula is broad, with the formula $20 \times 28 \cdot 0 \cdot 28$. There is no median tooth, but the cuticle contains a faintly reticulate substructure. The number of marginals increases towards the growing end. The first marginal tooth is more than twice the size of the second marginal: the largest first marginal measures approximately $300 \mu\text{m}$ in length. Each of these large teeth has a long, narrow root and a long, curved, pointed cusp. Root size in proportion to the cusp diminishes towards the outer edges of the radula. The outermost marginals exhibit abruptly recurved tips (Figure 1D). No recognizable jaws survived caustic treatment.

A squash preparation of the retracted penis shows that there are spines lining the lumen. They take the form of triangular arrowheads, approximately $6.6 \mu\text{m}$ long (Figure 1C).

Remarks: Two similar species of *Gymnodoris* exist and have posed difficulties in identification. *Gymnodoris bicolor* (Alder & Hancock, 1864) and *G. citrina* (Bergh, 1877) have been differentiated by the size of the first marginal tooth relative to body size, by the shape of the second marginal, and by the size difference between the first and second marginals. In *G. bicolor*, the first marginal tooth is small in relation to body length; the shape of the second marginal is elongated and triangular; and the second marginal is only slightly smaller than the first marginal. In *G. citrina*, the first marginal is large relative to body length; the second marginal has an awl-shaped cusp and a broad base; and the second marginal is very much smaller than the first, less than half the size. In my specimen, the ratio between body length and first lateral is intermediate, and the first marginal is more than twice the size of the second marginal.

Other, less ambiguous, characteristics follow. The location of the genital opening relative to the gills differs in both species: in *G. bicolor*, the aperture is posterior (KAY & YOUNG, 1969) and in *G. citrina* anterior (YOUNG, 1967) to the gills. The cirral hooks of *G. bicolor* are $24\text{--}36 \mu\text{m}$ long (KAY & YOUNG, 1969) whereas in *G. citrina* they are an order of magnitude smaller, $7\text{--}8.5 \mu\text{m}$ (YOUNG, 1967). In my specimen they were approximately $6.6 \mu\text{m}$ long. The V-shaped arrangement of papillae on the dorsum also seems to be characteristic of *G. citrina*.

Distributions of *G. bicolor* and *G. citrina* are uncertain because ambiguous radular descriptions and incomplete morphological descriptions have not been sufficient to enable one to distinguish between the two. Certain identifications of *G. citrina* indicate a western Indo-Pacific distribution: Palau Island (BERGH, 1877), Eniwetok Atoll (YOUNG, 1967), and now Sri Lanka.

Chromodoris conchyliata Yonow, spec. nov.

(Figures 2 and 9A, B, C)

Material and locality: One specimen found under dead coral at a depth of 4 m in Koduwakattumalai Bay (35 km north of Trincomalee), on 7 August 1981.

Holotype: BM(NH) 19837 W.

Description: The animal was 15 mm long, with the foot extending beyond the mantle. The anterior and posterior ends of the mantle and the rear of the foot are edged with a milky white band. The anterior part of the mantle is bilobed. The body is pale violet with rounded areas of creamy yellow, and deeper violet and red markings. There are 3 dark violet markings on the dorsum: a V-shape near the front with the ends pointing towards the rhinophores, 2 broad lateral bands converging in the midline anterior to the gills, and an X-shape on the rear of the mantle. These dark violet marks redden in places and follow the contours of bilaterally symmetrical yellow spots (Figure 2A). Ventrally, the head, the simple oral tentacles, and the foot are white. The hyponotum is dark purple in the region that corresponds to the pale violet on the dorsum. Where the edging is white above, it is bright red ventrally, fading into white near the head (Figure 2B).

In lateral view, a longitudinal dark violet line can be seen between the foot and the mantle. The animal is fairly high when observed from this angle (Figure 2D).

The rhinophores are lamellated, colored red with white stalks, and retractile into sheaths (Figure 2C). The gills, 8 simple pinnate structures, are tricolored: the upper half is red, both rachis and pinnae, and the lower half has a pale violet rachis with white pinnae (Figure 2E).

The radular formula of the specimen is $43 \times 33 \cdot 1 \cdot 33$. The median tooth is vestigial. All the teeth have pointed denticulations, and the first tooth on either side of the median has a subsidiary cusp (Figures 2F and 9A). The jaw plates consist of blunt hooked rods, the largest about $2 \mu\text{m}$ long.

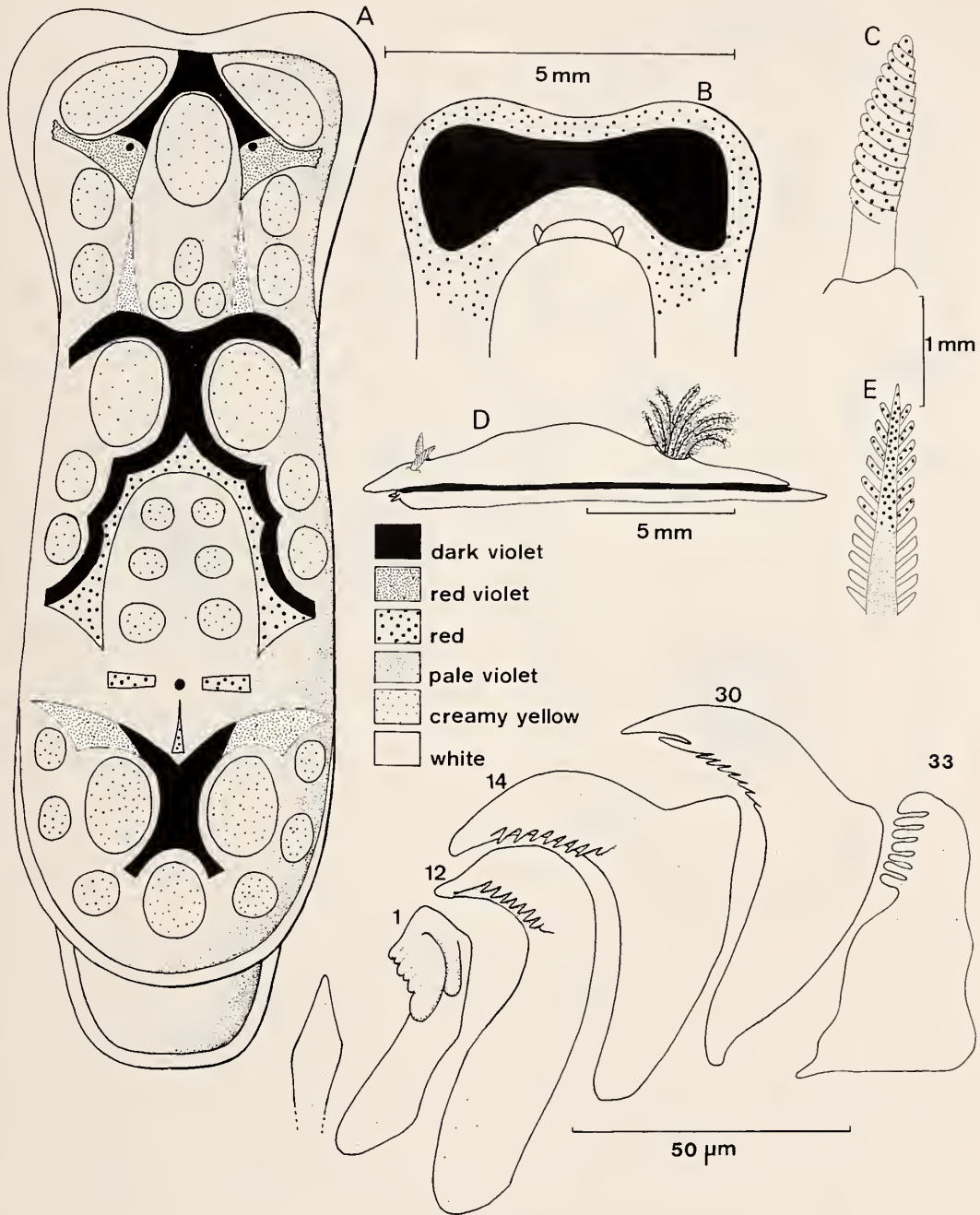


Figure 2

Chromodoris conchylata Yonow, spec. nov. A. dorsal aspect; B. ventral view of the head; C. side view of the rhinophore; D. lateral view; E. gill; F. radular teeth (with aid of camera lucida).

Remarks: This species is distinct from all previously described chromodorids in its color pattern, with 3 distinct sets of dark violet markings on a pale violet body color and the bilobed anterior margin, not a common feature in chromodorids. This species is distinguishable from *Chro-*

modoris geometrica Risbec, 1928, similarly patterned with violet markings. *Chromodoris geometrica* has rays of purple radiating from two parallel median bands (also purple); the rhinophores have white stalks with yellow lamellae; the branchiae are seven in number, each with a yellow

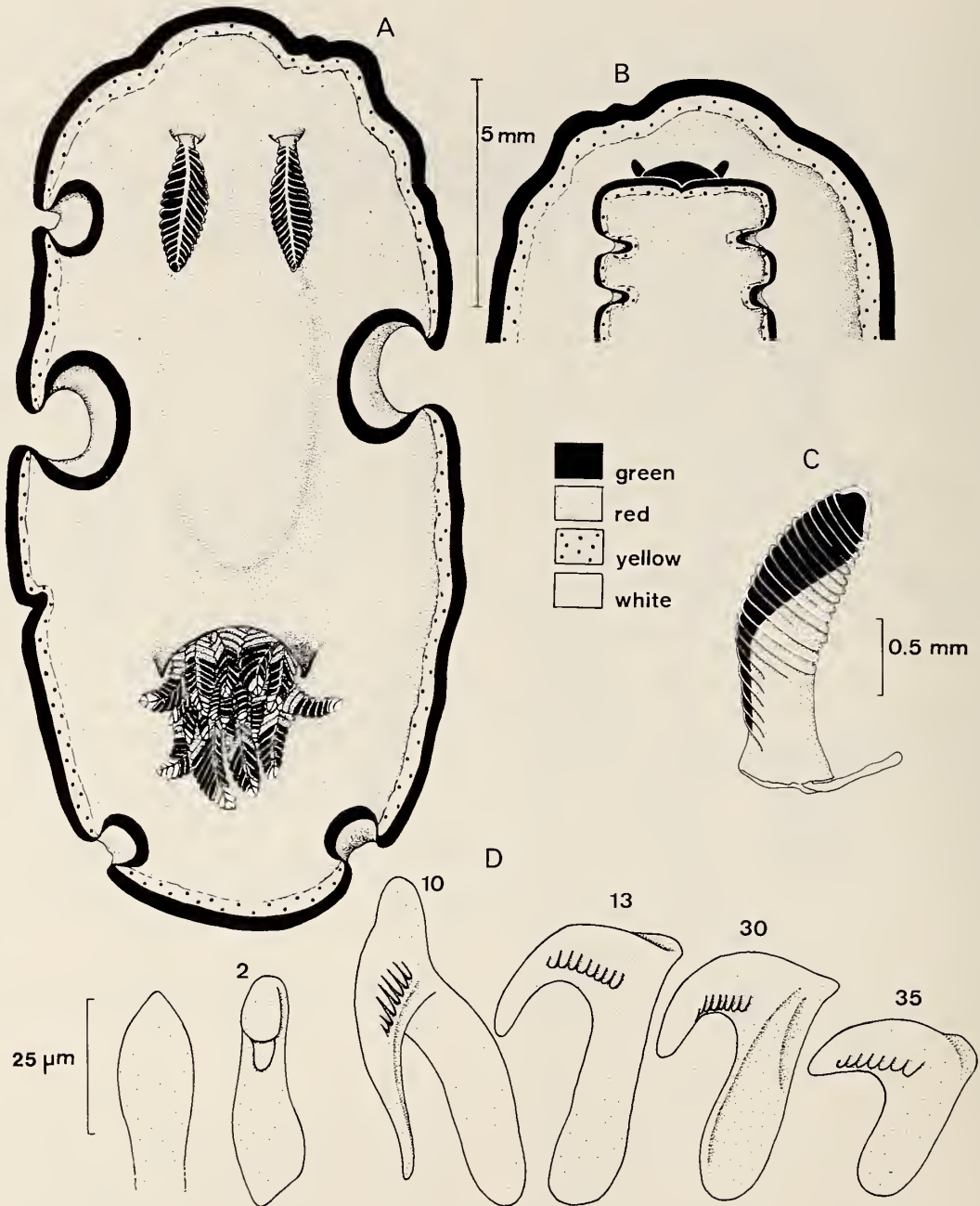


Figure 3

Chromodoris adeima Yonow, spec. nov. A. dorsal aspect; B. ventral view of the head; C. side view of the rhinophore; D. radular teeth (with aid of camera lucida).

rachis and transparent white pinnae (YOUNG, 1967). *Chromodoris geometrica* seems to be limited to the eastern Pacific: New Caledonia (RISBEC, 1928, 1953), New South Wales (ALLAN, 1947) and Eniwetock Atoll (YOUNG, 1967). The radular formulae are similar, as is the form of the teeth. The radula of a 22 mm-long specimen of *C. geo-*

metrica is $43 \times 28.0-28$; the teeth are $53-79 \mu\text{m}$ long and denticulate. The jaw plates consist of simple bifid hooks $32-39 \mu\text{m}$ long (YOUNG, 1967). RUDMAN (1973) also describes *C. cf. geometrica*, a chromodorid with purple reticulations. He states that the color is somewhat variable if the records from New Caledonia, Australia, Eniwetok,

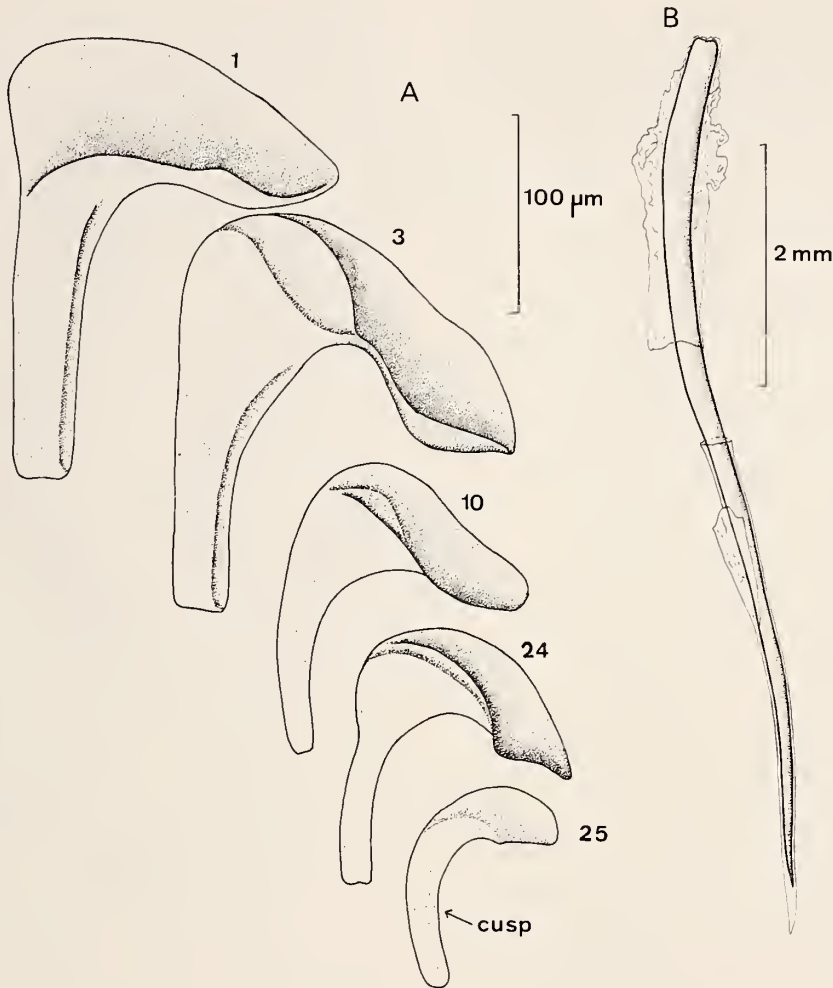


Figure 4

Kentroadoris rubescens A. radular teeth (with aid of camera lucida); B. vestibular stylet (with aid of camera lucida).

and Kenya are of the same species, but that the specimens are linked by (1) the orange-yellow rhinophores (mine were red) and gills (mine were pale violet and white with red), (2) the purple reticulate pattern, and (3) the white yellow pustules. The described specimen probably belongs to the same color group as the above, but is certainly a separate species.

The name *conchyliata* is derived from the Latin *conchyliatus*, meaning "dressed in purple."

Chromodoris adeima Yonow, spec. nov.
(Figures 3 and 9D, E, F)

Material and locality: One specimen, found in coral rubble 2.5 m deep, 15 km north of Trincomalee, on 11 August 1981.

Holotype: BM(NH) 19838 W.

Description: This was a fleshy animal, 20 mm long and 10 mm wide. The crenulate mantle completely covered the foot when the animal was crawling. The body is faintly papillate, but soft and strikingly marked. The dorsum is red with faint patches of mottled yellow and red. Along the edge of the mantle is a poorly defined line of red dots, some running together, outside of which is a creamy yellow band. External to the yellow is a vivid green band edging the upper and lower surfaces (Figure 3A). The foot, also fleshy and crenulate, has similar colorings to the mantle: it is a lighter shade of red edged with yellow and green. The foot is notched and bilabiate. The head and the simple oral tentacles are green (Figure 3B).

The rhinophores are unusually close to the end of the mantle, and retract into prominent sheaths. A rhinophore bears 23 lamellae, although the last 6 do not go all the way around the organ. The stalk is very short. The color

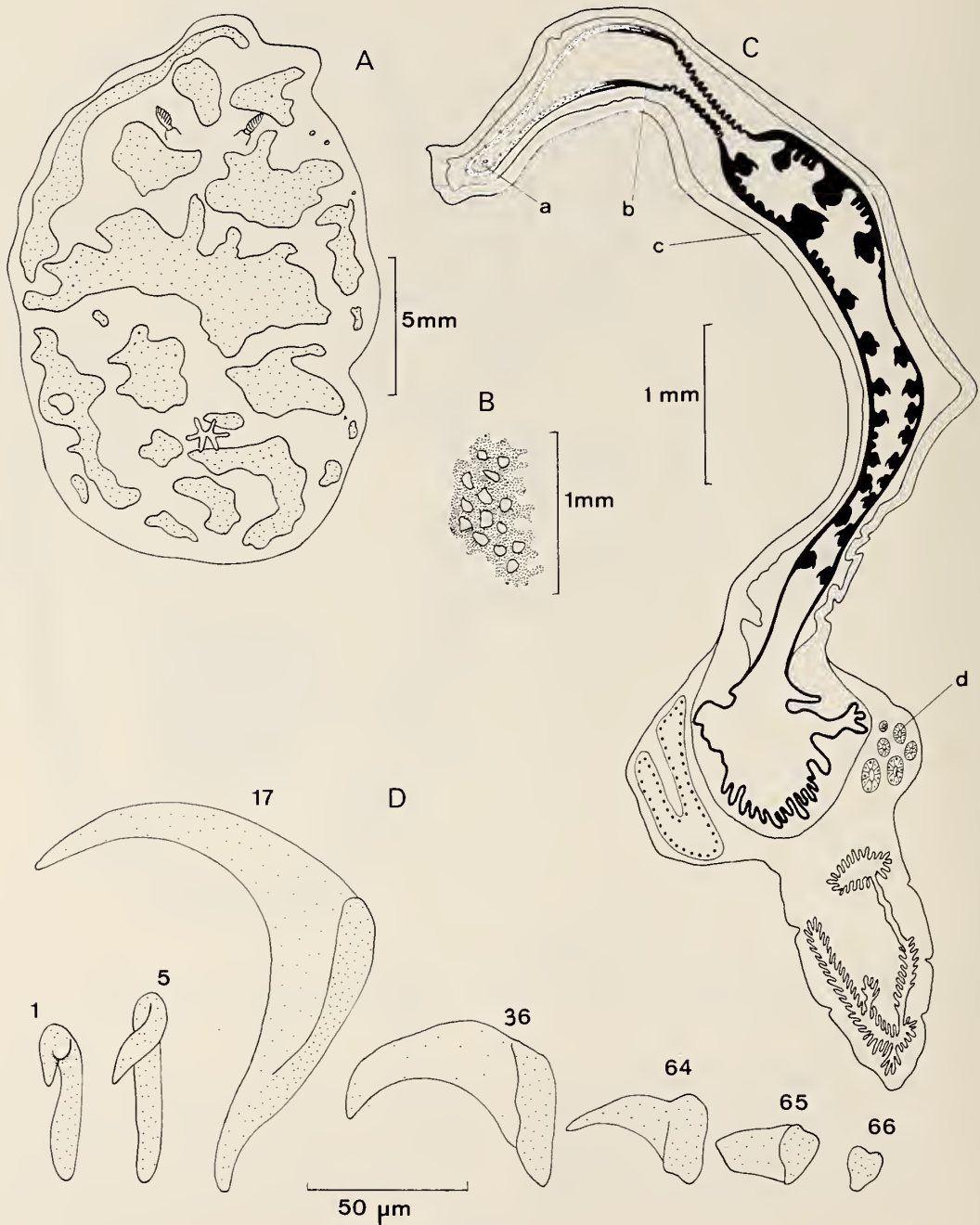


Figure 5

Platydoris scabra A. dorsal aspect of small specimen (semi-diagrammatic) drawn from preserved specimen; B. detail of dorsal pigment; C. penis (reconstruction), a = vas deferens, b = cuticularized penis, c = muscular body wall, d = accessory gland; D. radular teeth of larger specimen (with aid of camera lucida).

pattern on the rhinophore is interesting: the whole is sheathed in red, and underlying this layer is a green pigment which decreases in area towards the base, where the sides and back of the rhinophore are red and the anterior surface is green. The midline, where the lamellae stop just

short of meeting each other, is white for the entire length of the rhinophore (Figure 3C).

There are 19 fleshy gills, which retract into a large cavity with a raised edge. The outer ring consists of 11 larger gills, inside which are 8 smaller gills. They are

brightly colored, a red rachis with red pinnae at the base, green in the center, and white at the tip. When fully extended, the gills project beyond the mantle edge on both sides and at the posterior end.

The radular formula for the specimen is 38·1·38. The number of rows differs on the two sides: 109 and 116. The median tooth is triangular and the rest of the teeth vary in form and size along the row. By the third tooth, the cusp is long and, toward the new end of the radula, sharp. The knob at the juncture of the cusp and root diminishes as the teeth grow older, as does the length of the cusp. All the teeth in each row are denticulate, with 7–8 denticulations present only on one side (Figure 3D and 9D, E, F). The jaw plates are made of crescent-shaped, smoothly tapering rods, averaging 5 μ m in length.

Remarks: A number of Chromodorididae have a dorsal pattern similar to *Chromodoris adeima*, but the colors differ. *Casella atromarginata* (Cuvier, 1804) can be green with a white and black margin. *Chromodoris splendida* (Angas, 1864) is cream with red markings and a bright yellow-orange pallial edge. *Chromodoris preciosa* (Kelaart, 1859) is a white animal with a red border and yellow sub-margin. The colors of *C. adeima* as well as its radula are enough for it to be considered a distinct species.

In Greek, *adeimos* is one of the many words meaning "brave, bold and fearless."

Kentrodoris rubescens Bergh, 1876

(Figure 4)

Kentrodoris rubescens BERGH, 1876
MARCUS, 1976

Material and locality: One specimen found under a rock with much epiphytic growth 2 m deep, 15 km north of Trincomalee, on 31 July 1981.

Description: The live animal was 90 mm long and 25 mm wide. The specimen was soft, smooth, and slimy. The base color is beige with red-brown longitudinal linear markings. Yellow-green areas are present between some sets of lines. The lines are not continuous, nor of uniform thickness, so there are regions of beige devoid of lines as well as patches of red-brown where the beige is barely visible. The highest concentrations of dark pigment are found at the anterior and posterior ends, where the linear markings are shorter and thicker. The darker patches traverse the dorsum. The foot is concealed by the notum and is beige, with wavy linear markings, and the hyponotum extending beyond the foot is white. The dorsum is highest in the region of the branchiae, which are located slightly posterior to the mid-dorsum. There is a high sheath protecting a deep cavity into which a circlet of 7 gills is retracted. The gills when fully extended stand approximately 2 cm above the notum. They are bicolored: the proximal half is white and the distal red-brown. The rachis is white with branching pinnae.

The gill sheath is darker, because of converging and thickening lines, as are the prominent rhinophore sheaths. The lamellated rhinophores are almost 15 mm in length, with brown bases and white tips.

The radular formula is approximately 35 \times 25·0·25. All the teeth are squared except for the last one, which is rounded. The first lateral is distinctly different from the others: the root is stronger and wider, more square than rectangular. The first 7–8 teeth of each row have a groove along the inner surface of the cusp, not present in the other teeth. The end tooth in each row differs from the others in having a very rounded end, noticeable among the squared, blunt ends. The root of this last tooth is small and not very strong (Figure 4A). The jaw plate was caustic resistant, with no recognizable substructure.

The vestibular stylet is 7.5 mm long, chitinous, and enclosed in a membrane (Figure 4B).

Platydorid scabra (Cuvier, 1804)

(Figure 5)

Doris scabra CUVIER, 1804a
Platydorid scabra: MARCUS & MARCUS, 1959
EDMUNDS, 1971
SOLIMAN, 1978

Material and locality: Two specimens found in 2–3 m, 15 km north of Trincomalee, on 11–12 August 1981.

Description: The smaller specimen was 20 mm long and 15 mm wide, the body oval and flattened. It is granular, tough, and leathery to the touch. The dorsal side of the animal is creamy yellow, almost pale orange, with brown patches and speckles. The patches are paired and nearly symmetrical: 2 small patches anterior to the rhinophores and 2 larger patches just posterior to the rhinophores, in contact with the rhinophoral sheaths. The crescent-shaped patches are larger, meeting in the center and pointing toward the gill pocket. Two patches are located anteriorly in the crescent hollows and make the pattern transversely linear again. Posterior to the branchiae are 3 small patches arranged in a semi-circle around the pocket. Around the periphery are discontinuous lighter patches. A number of small spots are scattered among the large patches and around the edge (Figure 5A). The variations in color are caused by the presence and absence of small brown dots, which converge in regions of dark color (Figure 5B).

The ventral side of the mantle is creamy, devoid of pigment. The foot, although not pigmented, is darker than the hyponotum. It does not project beyond the mantle. The sides of the foot are finely speckled with brown dots which increase in concentration to form a line in the region between the dorsal surface of the foot and the hyponotum. This line is not visible from underneath when the animal is crawling.

The pallial edge is orange, visible only in lateral view. The rhinophores are lamellated and retract into prominent sheaths 1.3 mm across. The sheaths have a smooth

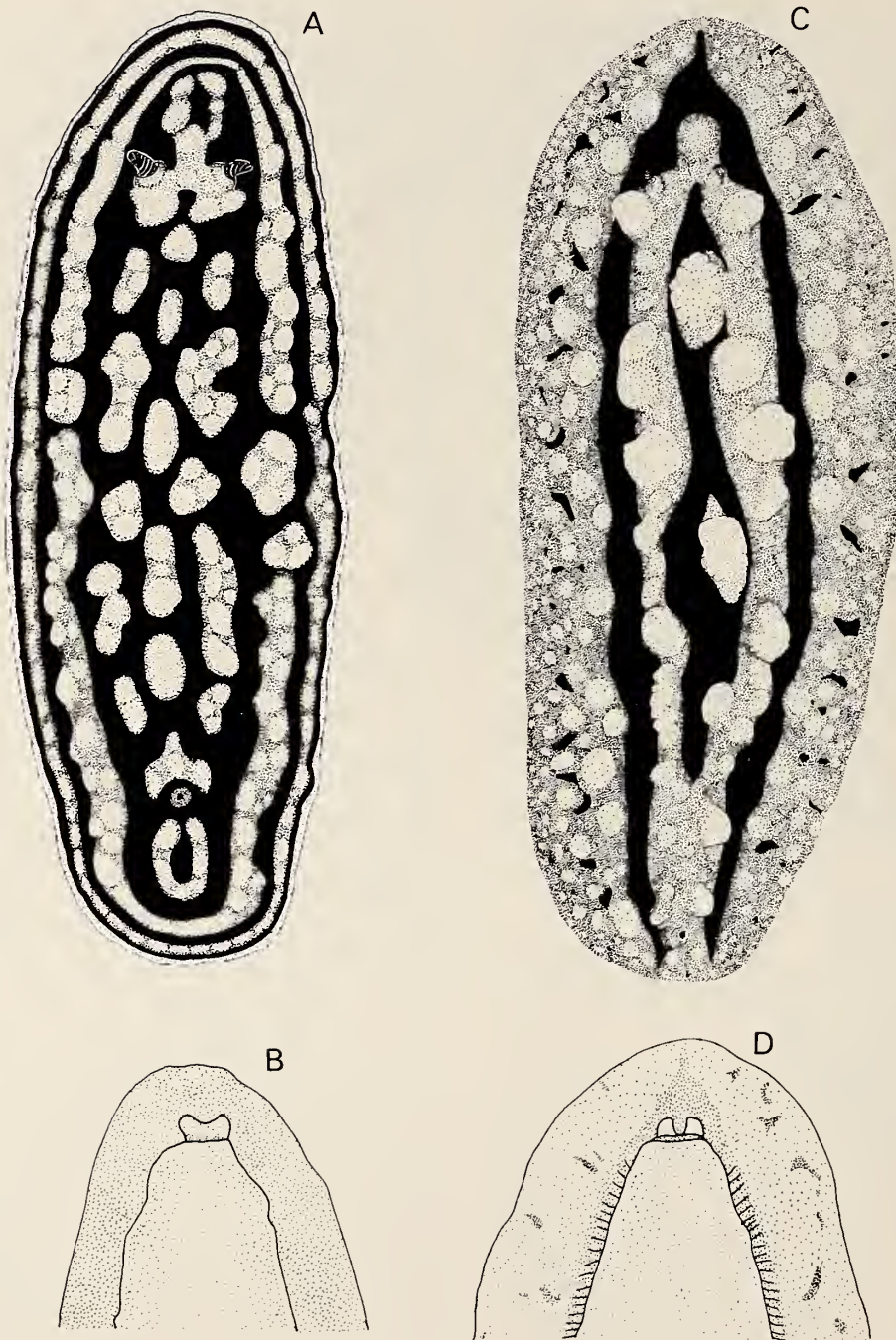


Figure 6

Phyllidia empelia Yonow, spec. nov., drawn from preserved specimen (holotype): A. dorsal aspect; B. ventral view of the head. *Phyllidia alia* Yonow, spec. nov., drawn from preserved specimen (holotype): C. dorsal aspect; D. ventral view of the head.

rim and are creamy in color, with a few faint radiating brown lines.

The 6 large gills are voluminous pinnate structures, contractile into a single cavity. The crenulated gill pocket

is star-shaped with a smooth rim, symmetrical on either side of the median. Like the rhinophoral sheaths, it exhibits the base color with even fewer markings on the outside edge; the inside is creamy.

The radular formula is $43 \times 99.0.99$, and the radula is 4.5 mm long and 3 mm wide. The teeth are long hooks, approximately $16 \mu\text{m}$ long, with relatively small roots. The first tooth, however, has a long rounded root and short cusp, but the second tooth in the first 16 rows has the typical pointed cusp. The second and subsequent teeth onwards of row 16 are twisted. The last few teeth in each row degenerate rapidly into blunt, rounded, irregular structures.

The penis was sectioned to look for spines and a reconstruction has been drawn (Figure 5C). The penis is retracted and the spines line the lumen, which is cuticularized. The spines are large boss-like structures with a small curved spine at the end, the largest measuring $450 \mu\text{m}$ high and $375 \mu\text{m}$ wide.

No description is available from life for the second specimen. In alcohol it measures 39 mm in length and is 34 mm wide. The dorsal pattern is preserved and will be described. This pattern differs from the previous specimen and from other *Platydorid* *scabra*. There is a dorsal rounded triangular shape very lightly pigmented, and the region surrounding it is dark. The brown pigment is in the form of dots identical to the smaller specimen. The pallial edges are crenulate, each indentation showing an increase of brown pigment. The area behind the gill is darkly pigmented, and the area anterior to the rhinophores is somewhat lighter. The ventral side is exactly as described for the first specimen, with a long (23 mm) narrow foot. The pigmented region between the foot and the mantle is 10 mm wide.

The rhinophore sheaths are 2 mm in diameter and the gill pocket 5 mm across.

The radular formula is $36 \times 66.0.66$. The teeth are smaller than those of the first specimen, the largest with a cusp $100.56 \mu\text{m}$ long. The teeth are as for specimen 1, the first tooth with a shorter cusp than the following teeth. The twisting-over occurs further along the row at the growing end: in row 15 the twisting is visible in the sixth tooth, but from row 19 onwards, the second tooth is twisted (Figure 5D). No recognizable substructure of the jaw plates survived caustic treatment.

Phyllidia empelia Yonow, spec. nov.

(Figures 6A, B, 7A, 8A, B)

Material and locality: Two specimens found on the sides of large rocks, 2 and 4.5 m deep, in Koduwakattumalai Bay, on 7 and 12 August 1981.

Holotype: BM(NH) 19839 W/1.

Paratype: BM(NH) 19839 W/2.

Description: The smaller specimen (holotype) is 20 mm long and 7.3 mm wide in alcohol. The oval body is elongate, completely concealing the foot. The base color is black, and the tubercles are gray. The animal is softer and more flexible than the other species of *Phyllidia* found

in Sri Lanka. The gray oral tentacles are squarish and joined together at the base. The foot is also gray, without a median line (Figure 6B).

The dorsal pattern is conveniently described from the pallial margin to the midline. A thin gray band without tubercles encircles the animal. Inside this is a thin black stripe (just visible in places on Figure 8B). Also forming a complete oval is the first row of tiny tubercles: these are gray and single, and the gray region around the bases merges into a continuous gray band. Inside this is a flat black band, followed by another row of tubercles. These are larger, 1 mm across, and multi-tuberculate, with a maximum of 3 tubercles. This row has 2 indentations in the oval, near the center at the widest point of the animal, corresponding with 3 tri-tuberculate lumps. The next black band is adjacent to and external to the rhinophores. Inside this black band the tubercles emerge with some regularity. A ring of 6 tubercles is found anterior to the rhinophores, and another ring is found posterior to the anus. The median tubercles then alternate between both sides and the center, some single and some compound. There are 9 tubercles down the center, rounded towards the anterior and posterior ends, and elongated in the middle (Figure 6A).

The rhinophores and anus are just inside the third black stripe. The black rhinophores are lamellated and large in comparison to other Phyllidiidae; the sheaths are gray. The anus is a small slightly raised gray tube exactly on the midline.

The larger specimen (paratype) is 26 mm by 10 mm in alcohol. It conforms to the above color description, but proportions vary slightly. The first gray and black lines of the margin are very fine, scarcely visible. The first row of tubercles is as described, but the tubercles in the second row are elongated transversely, forming a ring of perpendicular ridges around the edge. The four posterior tubercles merge with the outer row of single tubercles and the fine gray line that surrounds the whole. The median tubercles have the same patterns described above but there are 10 tubercles down the center (Figure 8A).

The foot is gray, lacking a median line, and is marked transversely with two black slashes; one crosses the foot and the other crosses over just half the foot. The oral tentacles are as previously described.

The long, pointed rhinophores are sheathed and lamellate. Unlike most nudibranch rhinophores, the 16 lamellae in this species are very short; they do not grow diagonally across the length of the rhinophore and they overlap each other from the base to the tip. Only at the distal tip do the lamellae actually meet in the dorsal and ventral midline of the rhinophore. The subsequent 11 lamellae stop short of the base, the last 6 running perpendicular to it. The rhinophore of this second specimen has a length of 2 mm (Figure 7B).

Remarks: This species has a number of characteristics that serve to distinguish it from other Indo-Pacific and Pacific Phyllidiidae. It seems similar to *Phyllidia nobilis*

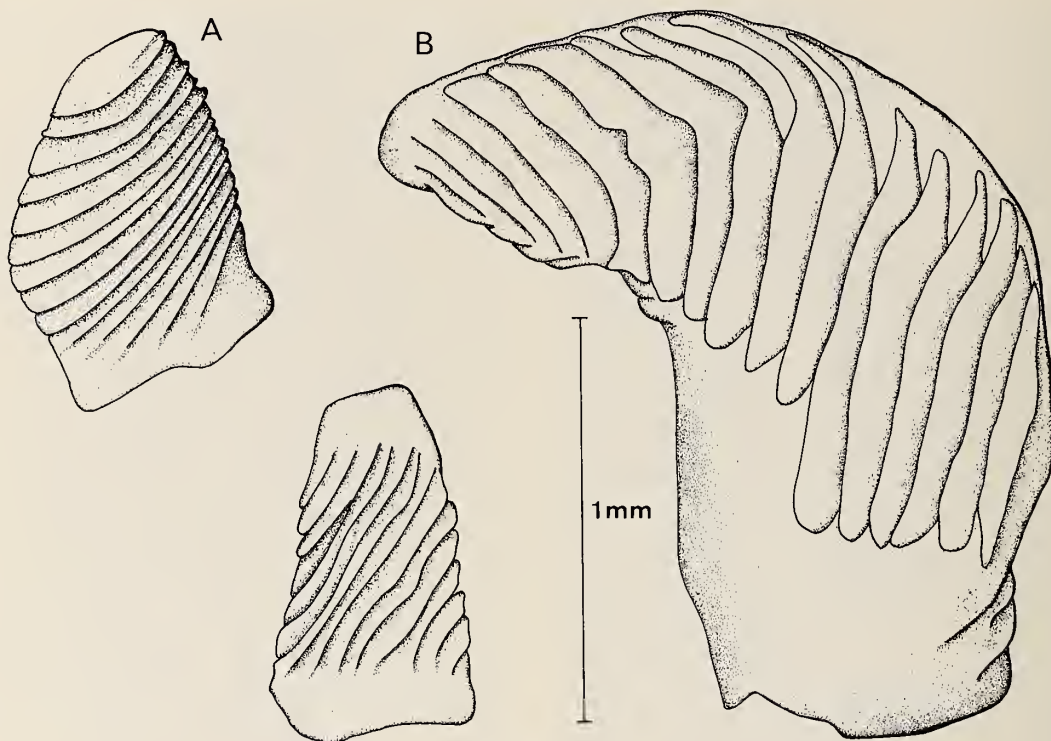


Figure 7

Rhinophores: A. *Phyllidia alia* Yonow, spec. nov., drawn from preserved specimen (holotype); B. *P. empelia* Yonow, spec. nov., drawn from preserved specimen (paratype); C. *P. varicosa*, drawn from preserved specimen.

Bergh, 1869, as described by EDMUNDS (1972), ELIOT (1904a), and RISBEC (1953). However, both Sri Lankan specimens were gray and black, with no trace of orange or green as recorded by these authors. My two specimens show some variation in size and shape of the tubercles, but follow the same sequence of pattern: two uninterrupted rows of gray tubercles surround the whole dorsum, plus one that is broken on each side but continuous around both ends. *Phyllidia albonigra* Quoy & Gaimard, 1832, from Tonga vaguely resembles *Phyllidia empelia*, but the anterior and posterior extremities of the Tongan species are pointed, and the compound tubercles are not arranged in any definite pattern. *Phyllidia zeylanica* Kelaart, 1859, is similar in pattern to *P. empelia*, but *P. zeylanica* has pink tubercles and pink and black rhinophores. On my specimens, the rhinophores are completely black, and noticeably large, a fact not mentioned by previous authors.

Because of the lack of color in this species, I have called it *empelia* from the Greek *empelios*, meaning "gray."

Phyllidia alia Yonow, spec. nov.

(Figures 6C, D, 7A, 8F, G)

Material and locality: Two specimens found 1 m and 4 m deep, respectively, on the sides of rocks in Koduwakattumalai Bay, on 3 and 7 August 1981.

Holotype: BM(NH) 198310 W/1.

Paratype: BM(NH) 198310 W/2.

Description: The first specimen (holotype) measures 22 mm by 8.5 mm in alcohol, oval and elongate, in conformity with the majority of Phyllidiidae. In this specimen, however, the body color is white with black lines and yellow splashes on the tubercles. The white mantle edge is flattened, with tiny blisters around it, and a few spots of black. This white band is 2.5 mm wide, narrowing at the anterior and posterior ends. At its inner margin is a row of larger blisters, tipped with yellow. Two lines of black pigment run down either side, beginning at a point on the anterior edge of the mantle and ending posteriorly on either side of the anus, which is located on a yellow tubercle along the midline. These black regions are non-tuberculate. Inside this is an ellipse of large simple, grainy tubercles. The largest ones (whiter in the photograph, Figure 8F) are bright yellow in color. The smaller white tubercles have bases that tend to merge with one another. The rhinophores are located on the anterior edge of this ellipse and the anus at the posterior. The midline is a black line which divides at the base of each of 3 large yellow tubercles, running around them and meeting again on the other side (Figure 6C).

The rhinophores are bright yellow, lamellated, and



A



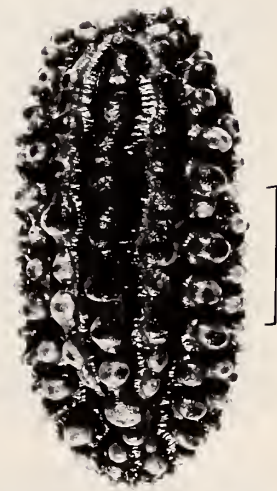
B



C



D



E



F



G

Figure 8

A and B. *P. empelia* Yonow, spec. nov.; C, D and E. *P. varicosa*; F and G. *P. alia* Yonow, spec. nov. Scale = 1 cm.

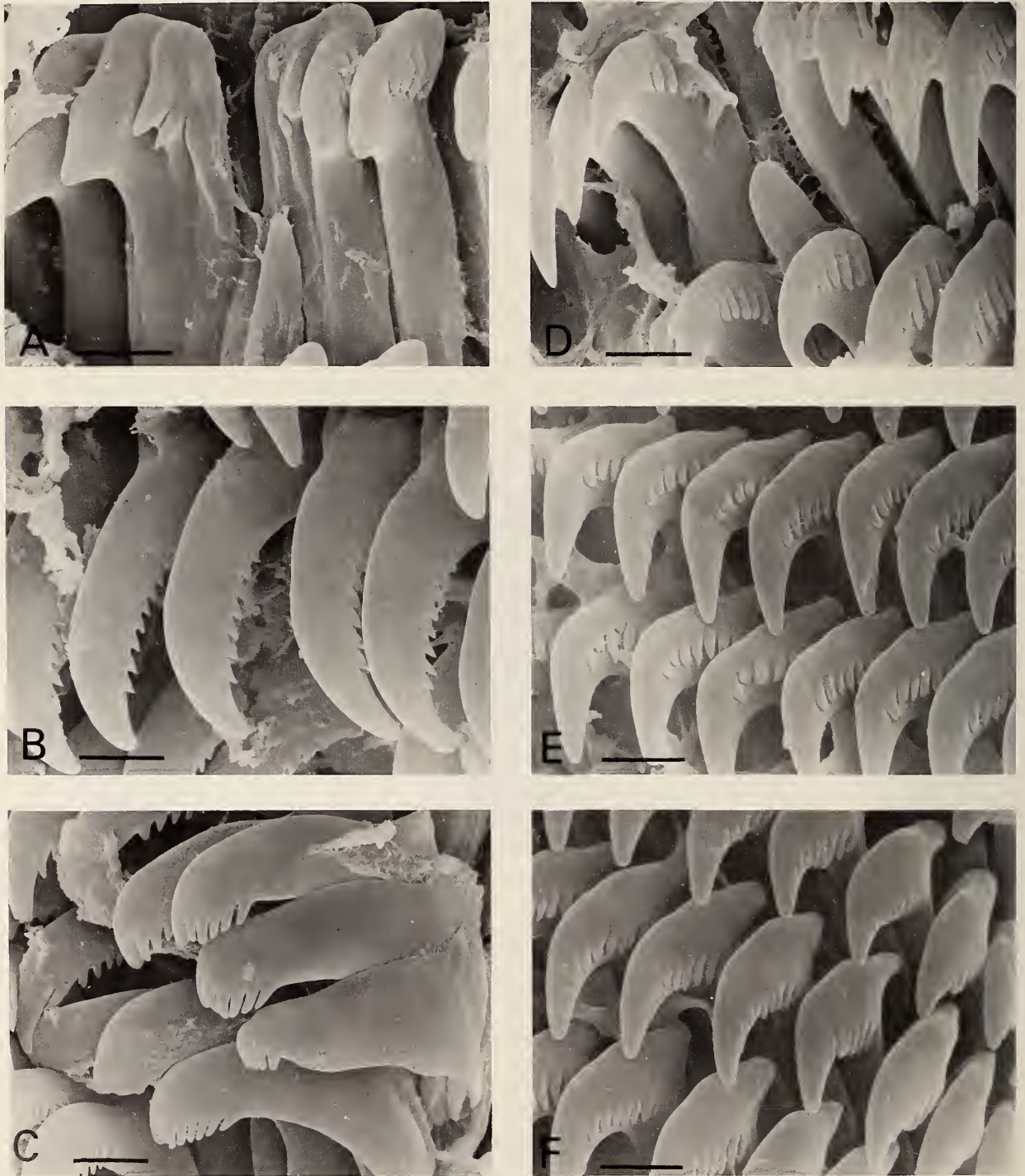


Figure 9

Scanning electron micrographs of chromodorid radulae. Scale = 10 μm . *Chromodoris conchylata* Yonow, spec. nov.: A. midline of radula; B. center of radula; C. outer edge of radula. *Chromodoris adeima* Yonow, spec. nov.: D. midline of radula; E. center of radula; F. outer edge of radula.

sheathed. The drawing (Figure 7A) is of a preserved specimen: the rhinophores are short and squat, and the 14 lamellae run almost parallel to the sheath. They overlap each other from distal to proximal, and the last 4 do not meet at the midline. In the photographs of live material, the rhinophores are slightly curved, finger-like projections, approximately 2 mm long. The gray oral tentacles are bulbous with a rounded point on the inner edge, attached separately to the head. Surrounding the foot on the hyponotum, the gills are visible as short transverse black lines, and the dorsal pattern of black shows through the thin mantle (Figure 6D).

The second specimen (paratype) was larger, 30 mm long and 12 mm wide in alcohol. The pattern is exactly as for the first specimen, with 3 large tubercles down the central black line. The anus, located on a tubercle in the midline, can be clearly seen in the photograph (Figure 8G).

Remarks: This species was easy to establish as different from other described Phyllidiidae. The pattern is striking and almost exactly the same in both specimens. *Phyllidia alia* resembles *Phyllidia pustulosa* Cuvier, 1804, but differs in the thinness of its mantle edge, the lack of a regular pattern in the tiny blisters interspersed with black markings around the edge, and the presence of two uninterrupted black lines on the dorsum. *Phyllidia pustulosa* is said (PRUVOT-FOL, 1956) to have "tubercles on the pallial edge sometimes grouped in triangular shapes, reminding one of drawings of *Phyllidia varicosa* Lamarck, 1801, and *Phyllidia elegans* Bergh, 1869. In general, in most of the individuals figured, there are only vague irregular rows on the edge of the mantle." BABA & HAMATANI (1975) describe *P. pustulosa* as slightly variable, but generally with compound warts of 2–6 partially-united smaller warts. The tubercles around the margin tend to be isolated. CUVIER's (1804b) drawing of *P. pustulosa* does not resemble these specimens. PRUVOT-FOL (1956) has further confused matters by misspelling *P. pustulosa* as *P. pustulata* in the heading of her description. Neither she, BABA & HAMATANI, nor CUVIER refer to the two distinct black lines on the dorsal surface, which serve to distinguish *P. alia* species from any other *Phyllidia*.

Alia is Latin, meaning "another."

Phyllidia varicosa Lamarck, 1801

(Figure 7C, 8C, D, E)

Phyllidia varicosa LAMARCK, 1801

ELIOT, 1904b

EDMUNDS, 1972

BABA & HAMATANI, 1975

P. trilineata CUVIER, 1804b

QUOY & GAIMARD, 1832

Material and locality: Three specimens found at depths of 1 m and 4 m in Koduwakattumalai Bay, on 3 and 7 August 1981.

Description: The specimens are oval in shape and hard to the touch. All have the distinctive mark of *Phyllidia varicosa*: an interrupted black line down the center of the gray foot.

Specimen 1 measures 28 mm by 14 mm (22 mm × 10 mm in alcohol) and has the dorsal markings of a typical *P. varicosa*. Two pairs of black lines run longitudinally, with 3 ridges of yellow-tipped tubercles between them. The tubercles have a grainy appearance. The central ridge terminates with a knob containing the anus. The ridges on either side begin just posterior to the rhinophores. The edge of the mantle is more solid than in the other two species and contains ridges of tubercles alternating with solitary tubercles, surrounded by black. The first tubercle of each transverse ridge is large and yellow. The solitary tubercle is sometimes followed by a row of small tubercles down to the mantle edge. Some of these second tubercles are also yellow.

The yellow rhinophores are sheathed, finger-like projections with 14 lamellae running diagonally down the organ. They start in a straight line at the distal end and stop in a straight line just before the base, which makes them conspicuous. The rhinophore is almost symmetrical in lateral view, like a tall trapezoid with a narrow base (Figure 7C).

Specimen 2 measures 55 mm by 25 mm in alcohol. The markings are similar to specimen 1, but the 3 rows of tubercles down the back cannot be described as ridges: they are more like tubercles with their bases merging, less delicate than the first specimen. These tubercles are orange. The orange rhinophores are sheathed and lamellated, located as described above. The anus is present on the last median tubercle.

Specimen 3, measuring 39 mm by 16 mm in alcohol, is a more extreme form of specimen 2: the typical pattern is still present, but more indistinct. The orange tubercles are all much larger, elongated projections, different from the grainy ridges of specimen 1. The first tubercles of the transverse rows merge longitudinally, creating a discontinuous third band of tubercles. The other details are as described above.

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